PASTEUR'S NEW PROCESS FOR THE MANUFACTURE OF BEER*

DURING the last few years several improvements have been introduced into the manufacture of beer; in Germany especially, land of sauer-kraut and hops, much attention has been devoted to this spicy and delicate question. In general, however, the apparatus for this manufacture leaves much to desire, and to this day brewers are far from being in possession of a process anything like perfect. Scientific men have given scarcely any attention to the question, which, perhaps, they consider unworthy of their study; while, like the rest of mortals, overcome by the heat and burden of the day, they perhaps have not disdained at times to raise to their lips the golden beverage, which even the most dainty prefer to the ancient and divine nectar.

Happily, we have commenced to review our past errors; the great masters of science have consented to descend from the ethereal heights of their empire, and to bring to bear upon industrial art their precious co-operation. For my part, I prefer a result to a formula, an application to a cloudy theory. Should some, losing themselves in impenetrable mists, turn away their attention with alarm from the useful pursuits of these men of science who approach with satisfaction the vulgar necessities of this world, let them do so, so long as M. Liebig is willing to be the world's cook, and M. Pasteur its brewer! It is an established fact in the eyes of earnest men, that "science," as Flourens said, "ought not merely to remain a source of self-satisfaction to the soul who has acquired it, and been elevated by it above the crowd, and that it becomes false as soon as it ceases to be profitable to that crowd." Dunoyer said with justice that "he who is a man of science, and nothing more, knows only how to make science useless to himself."

M. Pasteur is one of those men essentially scientific and keensighted, who understand the saying Geoffroy St. Hilaire one day made to re-echo through the Institute, "The social question is the first with which to occupy ourselves at the present day." But it was in that same room that Bert exclaimed, "Let us continue to study Nature in her most secret processes, to discover, to measure, to calculate the forces that she brings into action, having no thought of any useful applications we can put our studies to. Without doubt, with his friend Gay-Lussac, the great mathematician would reproach Pellegrini-Savigny with having degraded Science in occupying himself with questions as to alimentation. But on the other side we have the names of Berthollet, Monge, Chaptal, Conté, d'Alembert, Franklin, Geoffroy St. Hilaire, Arago, and especially Pasteur, for whom posterity will undoubtedly have a profound respect. M. Pasteur has added to his other fruitful inventions a new process for improving the manufacture of beer, for which he asked a patent in June 1871 in the following terms:—

"I desire to take out a patent for five years for a new mode of manufacturing beer, which consists essentially in fermentation sheltered from all contact with air.

"The wort, after being boiled, is turned into vessels of wood or iron, cooled in a current of carbonic acid gas; and then put to ferment.

"This process is founded upon new scientific data which I have expounded elsewhere, and from which it follows that contact with air is most injurious to the manufacture of beer. It is applicable to mild and strong, brown or pale ales.

"I wish the beers made by my process to bear in France the name of *Bières de la Revanche Nationale*—I shall say why elsewhere—and abroad that of *Bières françaises.*

"The disuse of cooling *bacs.*

"No loss by evaporation, &c.

"The abolition of store cellars, for future use.

"An increase of the quantity produced, and, at the same time, an increase in the strength of the beer.

"The development of a very agreeable 'bouquet.'

"No further use for ice-houses, for fermentation at a low temperature.

"Such are some of the principal advantages to be derived from the application of my process, and some of the qualities that will mark the beers *de la Revanche.*"

On Nov. 4, 1871, an additional certificate, accompanied by the sketch here reproduced, was deposited at the Prefecture of the Department of the Seine.

"The annexed sketch," says M. Pasteur in this addition, "represents the construction of the apparatus for the application of the new process of beer manufacture. A description of the design accompanies it.

"The size of this apparatus varies with the importance of the manufacture. It can be made of any size, from one hectolitre to 100,000 hectolitres. When the apparatus is of a somewhat considerable size, the employment of carbonic gas is indispensable to prevent the formation of deleterious ferments—lactic ferment, butyric ferment, injurious alcoholic ferment, &c. The employment of air, previously purified by calcination, by passing it through cotton, or by any other mode, is also a remedy for this drawback. A very small quantity of air is not injurious, perhaps even ultimately improves the quality of the beer. The beer can absorb all the flavour which malt and hops can give it; it can acquire a thoroughly free taste, sparkling limpidity, great strength, and in general all its characteristic qualities, only if we can totally, or in a very large measure, suppress the combustion which takes place in the ordinary process.

"We can also fill up the void which is made in the apparatus during the cooling of the wort, by bringing the apparatus into connection with a vessel full of warm wort, to kill the seeds of disease in the wort and in the beer which is the ultimate result.

"A man-hole is necessary at those parts of the apparatus marked F, F, when they are of great size.

"The cylinders should be surrounded with a muffler of flannel."

On November 25, 1871, M. Pasteur added a new improvement to his invention.

"The facility with which my apparatus may be applied will be increased by the employment of carbonic acid gas, after a more convenient fashion.

"The carbonic gas produced during fermentation, after having passed through a washing-flask, to be freed from any froth it might hold, is delivered into a zinc or tin reservoir, placed a little below the fermenting apparatus. At the lower part of this reservoir are arranged a number of sockets or taps. When it is desired to cool the wort in presence of the carbonic acid, as it is useless to mix up this gas with the liquid, it is sufficient to put one of the taps of the reservoir in communication with one of the tubes of the apparatus F, F, F′. This arrangement enables us to do without a gasometer, and obviates all the difficulties that could result from the movement of a gas which ought to overcome the resistance of liquid. Moreover, as the reservoir always keeps itself full, its capacity need not be very large.

"With a rapid cooling we can dispense with the use of carbonic acid; we can even allow ordinary air to enter in proportion as the bulk of the wort diminished while cooling."

The germs of disease in the wort are killed in the boiling wort, and those which the volume of free air just mentioned may carry, will not have time to develop in the wort, if the cooling process has been prompt—a condition always easy to bring about by having a suitable flow of water, and by having the bulk of wort always comparatively small.

"In reference to these assertions, it may not be useless to recall the proof I formerly gave of the remarkable fact, that liquids the most variable, even common household broth, preserve their limpidity for years by being kept from contact with air, provided that they be deprived of their germs. In the ordinary processes for manufacturing beer, all these germs are carefully accumulated in the wort, and even in the beer; and besides, the aromatic part of the hops is utterly destroyed by the oxygen of large masses of air; hence a deterioration of the product and a difficulty in keeping it.

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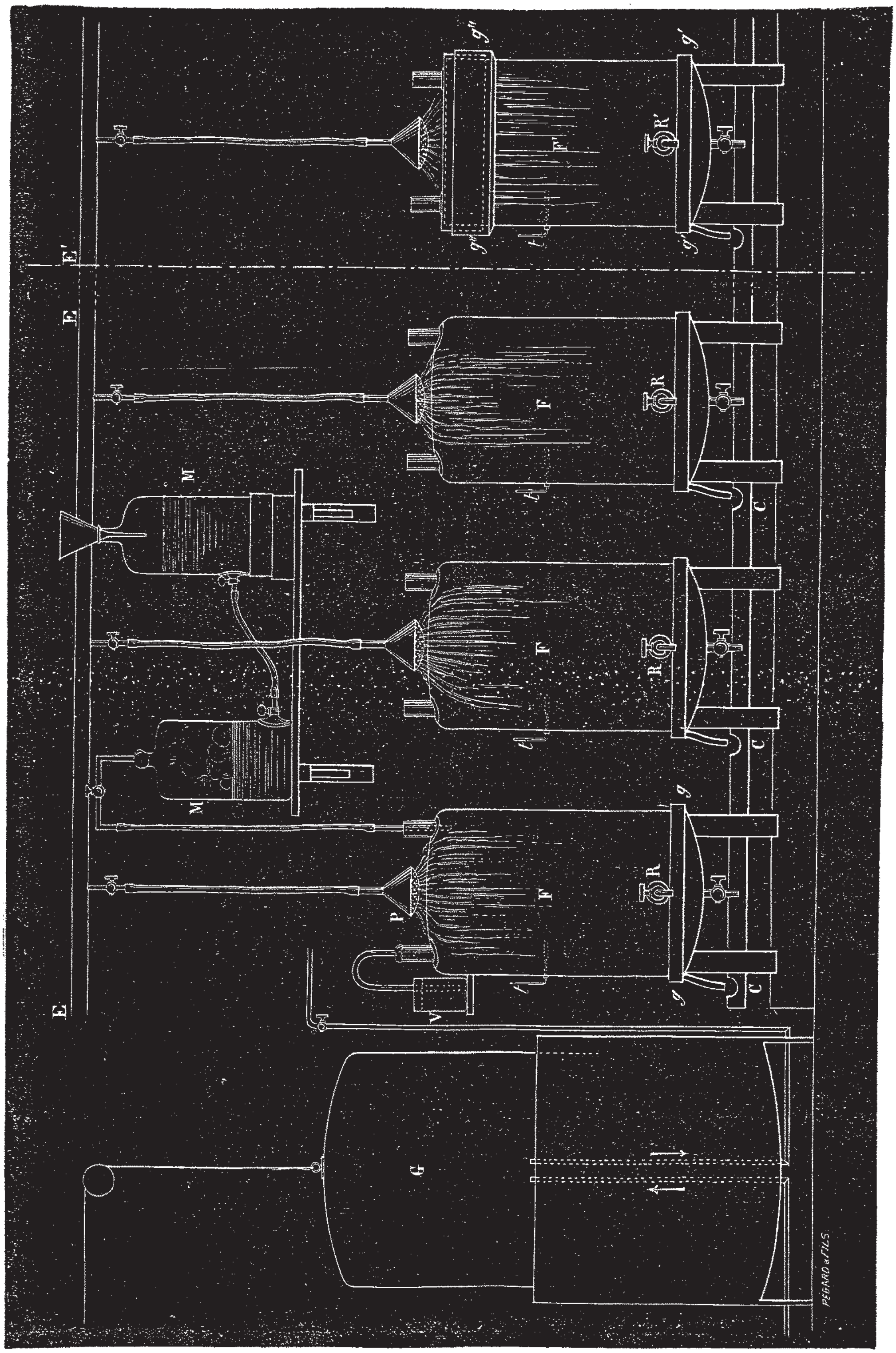
* Translated from an article by M. A. Jouglet, in the *Moniteur Scientifique* for September 1872.

APPARATUS FOR PASTEUR'S PROCESS FOR MANUFACTURING BEER

Lent by the Editor of the "Moniteur Scientifique."



E, E, E'. Pipe for receiving cold water which is distributed by the nozzles P into the fermenting apparatus F, F, F, F'. M, M. Apparatus for manufactured carbonic acid. C, C, C. Discharge-pipe for the water which is thrown out by the troughs g, g, g', where it collects very warm at the outset of the operation. F'. Another arrangement of the fermenting apparatus in which the moveable cover closes the cylindrical apparatus by means of the exterior trough g'', g'', with which the border of the cover dips. G. An ordinary gasometer, with a receiving and egress pipe. The fermenting gas of various apparatus can easily be turned into this gasometer, which afterwards supplies this gas when a new process is set agoing. t, t, t. Thermometers to indicate the temperature for putting in the yeast.

"The cooling of the wort can be hastened by various arrangements. One of the most simple consists in having serpentine or cylindrical tubes placed vertically in the interior of the vessels F, F′, where cold water circulates. The boiling wort can be turned into the fermenting vats themselves, to which the cooling tubes alluded to have been added, besides covering over these vats with a tin cover by hydraulic pressure, or else the boiling wort will cool in a large apparatus F or F′, fitted with cooling tubes for the circulation of water; then, at the moment when fermentation begins, the wort is turned into the fermenting vats closed by their hydraulic covers. It is even possible to make the common refrigerators serve by enclosing them in a vessel full of carbonic acid gas, or of air deprived of germs, and even ordinary air, if the vessel is of small capacity.

"To recapitulate:—the main and altogether novel principle of my process consists in the employment of vats of tin or wood, into which the wort is run as hot as possible, and is cooled by a current of water outside, or outside and inside at once, without any evaporation, over which there is absolute control; so much is this the case that, according to the terms of my patent, nothing is more simple than to transport the wort without danger to the greatest distances. With regard to the action of the air, we can limit it at pleasure, in so far as it is noxious, for we can always annihilate the mischievous influence of the germs it contains. The brewer has, moreover, the control over the action of free oxygen gas, so far as it consumes the aromatic or other very delicate principles. Besides, my process allows the temperature to be kept steadily at any height for the purpose of fermentation. In short, its advantages are valuable for the fermentation of German beer, or for mild fermentation, for we can proceed to the employment of ice or any other powerful means of cooling during the process of fermentation. There, is, however, no distinction between strong and mild fermentation, except in so far as the greater or less specific differences of two yeasts, strong and mild, are concerned. The two yeasts can be kept equal; the fermentation will be accomplished in the cold vats.

"Ere long I shall indicate how we may obtain at pleasure, at all seasons, and in all places, the two yeasts in a state of purity, without having recourse to those of the brewer.

"The ferment which is deposited at the bottom of the vessels, F′, is of a brown colour, because it is mixed with the deposit characteristic of the wort during the cooling process. It will be easy to collect it almost white, and without mixture, either by scraping the surface of the cake which it forms at the bottom of the apparatus, or by introducing at the outset into the apparatus, at the moment when we place the cover on the boiling worts, circular plates, attached to a bar which passes through the cover. This upright bar should terminate in the quadrant of a circle, round the extremities of which it can be turned, and moved up or down. While the wort is cooling, the plate of each apparatus will have its plane in a vertical position, and thus it will remain during the first days of violent fermentation. Then, when the ferment begins to settle down, the plate should be gently lowered until it is horizontal. After the product has been drawn off, a cake of ferment will be found upon the plate."

M. Pasteur made still another addition to this process, which was added to his patent in January 1872. It is as follows:—

"When the yeast in one pan is spoiled from any cause, it is necessary to have recourse to yeast taken from another pan. It then becomes a matter of importance to be able to prepare for one's self in any kind of vessel whatever a yeast deprived of all deleterious germs. I have solved this problem by discovering that the *Mycoderma vini* can be made the nucleus of a mild yeast. It can be made to develop itself in the wort of beer sheltered from contact with the air. I have also discovered that the fermenting principle of the grape is a mild yeast. It is a source to which breweries established according to my process can resort."

This addition is, in my opinion, of great importance. M. Pasteur's researches will not probably end here. Every day brings with it a new idea. At all events, from this time the manufacture of beer has received such valuable improvements as will tend to its increased production and use. The process has not yet received the sanction of long experience, but it appears to have fulfilled all that was expected of it. Some have asserted that M. Pasteur's system involves an enormous expense. I do not believe it; experience will show these objections to be unfounded.

After all I know very well that M. Pasteur may yet be the victim of envy. It will be remembered what annoyance an enemy gave him in connection with his process for improving wines.

M. CHEVREUL

A VERY interesting episode took place at the *séance* of the French Academy of Sciences of September 2, on the occasion of what may be regarded as the academic jubilee of the Dean, the famous chemist, M. Chevreul. The fiftieth year of his membership does not strictly occur till 1876; but it is well known that he would have been elected in 1816, had he not urged the Academy to give the vacant place to M. Proust, his compatriot, and a celebrated chemist, who was old and infirm, and could not afford to wait. M. Faye, as president of the Academy, intimated that the members had resolved, as a token of their estimate of his works, and their regard for his personal character, to present the venerable Dean that day with a medal, without waiting for the arrival of the formal jubilee. The medal represents the features of the illustrious chemist, who bears the weight of his 86 years much more lightly than many of his fellows who are considerably younger than himself. M. Dumas, the celebrated chemist, and permanent secretary of the Academy, in an eloquent and gracefully-worded speech, recounted the many valuable services rendered by M. Chevreul, who modestly styles himself "le doyen des étudiants français," and at the same time bore warm testimony to the personal character of the man. After M. Elie de Beaumont, who had been a pupil of M. Chevreul, had added a few words of veneration and respect for his old master, the latter attempted to respond, but had simply to express his inability to do so. It was in 1806 that M. Chevreul published his first most important work. He was collaborator of Vanquelin: and he has just completed a volume, entitled "Mémoires de l'Académie," a most interesting work, which throws light upon many of the most scientific questions of the day. M. Chevreul is one of the most distinguished chemists of the age; and, besides being Dean of the Academy of Sciences, is Director of the Museum of Natural History at the Jardin des Plantes. He has chosen for his motto that beautiful maxim of Malebranche, which indeed affords a true key to his life, his works, and his discoveries, "*Chercher toujours l'infaillibilité, sans avoir la prétention de l'atteindre jamais.*"

NOTES

IT is stated, on the authority of a private telegram from Bombay of Tuesday last, that letters from Dr. Livingstone, dated July 2, 1872, have been received at Zanzibar. He was still at Unyamyembe, was well, and waiting the arrival of Stanley's second expedition.

THE fourth three-yearly meeting of the French Institute will take place on the 2nd of October, and the yearly public meeting on the 25th of October.